



### Acknowledgement of Country

Kaya. The School Curriculum and Standards Authority (the SCSA) acknowledges that our offices are on Whadjuk Noongar boodjar and that we deliver our services on the country of many traditional custodians and language groups throughout Western Australia. The SCSA acknowledges the traditional custodians throughout Western Australia and their continuing connection to land, waters and community. We offer our respect to Elders past and present.

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Any resources such as texts, websites and so on that may be referred to in this document are provided as examples of resources that teachers can use to support their learning programs. Their inclusion does not imply that they are mandatory or that they are the only resources relevant to the course.

# Sample course outline

## Mathematics Methods – ATAR Year 11

## Unit 1

In Unit 1 students will be provided with opportunities to:

- understand the concepts and techniques in algebra, functions, graphs, trigonometric functions, counting and probability
- solve problems using algebra, functions, graphs, trigonometric functions, counting and probability
- apply reasoning skills in the context of algebra, functions, graphs, trigonometric functions, counting and probability
- interpret and evaluate mathematical information and ascertain the reasonableness of solutions to problems
- communicate their arguments and strategies when solving problems.

This course outline assumes an allocation of 4 hours contact time per week for the course. Each semester is based on a 15 week block.

Time placement (and allocation)	Topic/s	Key teaching points – Syllabus reference/s
Semester 1 (Unit 1)		
Weeks 1–2 (7 hours)	Topic 1.2: Trigonometric functions	<ul> <li>Cosine and sine rules (1.2.1 – 1.2.4)</li> <li>right-angled triangles and trigonometric ratios</li> <li>unit circle definition of cos θ, sin θ and tan θ and periodicity using degrees</li> <li>angle of inclination of a line and the gradient of that line</li> <li>establish and use the cosine and sine rules, including consideration of the ambiguous case and the formula Area = <sup>1</sup>/<sub>2</sub> bc sin A for the area of a triangle</li> <li>Circular measure and radian measure (1.2.5 – 1.2.6)</li> <li>define radian measure and degree measure using the unit circle and recognise relevant exact values</li> <li>calculate lengths of arcs and areas of sectors and segments in circles</li> </ul>
Week 3 (4 hours)	Topic 1.1: Functions and graphs	<ul> <li>Lines and linear relationships (1.1.1 – 1.1.6)</li> <li>coordinates of mid-points and end-point</li> <li>direct proportion and linearly related variables</li> <li>features of the graph of y = mx + c</li> <li>equations of a straight lines given sufficient information, including parallel and perpendicular lines</li> <li>solve linear equations, including those with algebraic fractions and variables on both sides</li> </ul>

Time placement (and allocation)	Topic/s	Key teaching points – Syllabus reference/s
		Semester 1 (Unit 1)
Weeks 4 (4 hours)	Topic 1:1 Functions and graphs	<ul> <li>Quadratic relationships (1.1.7 - 1.1.12)</li> <li>examine examples of quadratically related variables</li> <li>features of the graphs of y = x<sup>2</sup>, y = a(x - b)<sup>2</sup> + c, and y = a(x - b)(x - c), including their parabolic nature, turning points, axes of symmetry and intercepts</li> <li>solve quadratic equations, including the use of quadratic formula and completing the square</li> <li>equation of a quadratic, turning points, zeros, discriminant graph of the general quadratic y = ax<sup>2</sup> + bx + c</li> </ul>
Weeks 5–6 (8 hours)	Topic 1.1: Functions and graphs	<ul> <li>Inverse proportion (1.1.13 – 1.1.14)</li> <li>examples of inverse proportion</li> <li>equations of the graphs of y = <sup>1</sup>/<sub>x</sub> and y = <sup>a</sup>/<sub>x-b</sub>, including their hyperbolic shapes and their asymptotes</li> <li>Powers and polynomials (1.1.15 – 1.1.20)</li> <li>graphs of y = x<sup>n</sup> for n ∈ N, n = −1 and n = ½, shape, behaviour as x → ∞ and x → −∞</li> <li>coefficients and the degree of a polynomial</li> <li>expand quadratic and cubic polynomials from factors</li> <li>features and equations of the graphs of y = x<sup>3</sup>, y = a(x − b)<sup>3</sup> + c and y = k(x − a)(x − b)(x − c); shape, intercepts and behaviour as x → ∞ and x → −∞</li> <li>factorise cubic polynomials (in cases where a linear factor is easily obtained)</li> <li>solve cubic equations using technology, and algebraically in cases where a linear factor is easily obtained</li> </ul>
Weeks 7–8 (8 hours)	Topic 1.1: Functions and graphs	<ul> <li>Graphs and relations (1.1.21 – 1.1.22)</li> <li>features and equations of the graphs of x<sup>2</sup> + y<sup>2</sup> = r<sup>2</sup> and (x - a)<sup>2</sup> + (y - b)<sup>2</sup> = r<sup>2</sup>, their circular shapes, centres and radii</li> <li>graph of y<sup>2</sup> = x, shape and axis of symmetry</li> <li>Functions (1.1.23 – 1.1.28)</li> <li>the concept of a function as a mapping and as a rule or a formula that defines one variable quantity in terms of another</li> <li>use function notation; determine domain and range; recognise independent and dependent variables</li> <li>the graph of a function</li> <li>translations and the graphs of y = f(x) + a and y = f(x - b)</li> <li>dilations and the graphs of y = cf(x) and y = f(dx)</li> <li>distinction between functions and relations and the vertical line test</li> </ul>

Time placement (and allocation)	Topic/s	Key teaching points – Syllabus reference/s
		Semester 1 (Unit 1)
Weeks 9–10 (8 hours)	Topic 1.2: Trigonometric functions	<ul> <li>Trigonometric functions (1.2.7 – 1.2.16)</li> <li>understand the unit circle definition of sin θ, cos θ and tan θ and periodicity using radians</li> <li>recognise the exact values of sin θ, cos θ and tan θ at integer multiples of π/6 and π/4</li> <li>recognise the graphs of y = sin x, y = cos x and y = tan x on extended domains</li> <li>examine amplitude changes and the graphs of y = sin bx, y = cos bx and y = tan bx</li> <li>examine period changes and the graphs of y = sin bx, y = cos bx and y = tan bx</li> <li>examine phase changes and the graphs of y = sin bx, y = cos bx and y = tan bx</li> <li>examine the relationships sin (x + π/2) = cos x and cos (x - π/2) = sin x</li> <li>prove and apply the angle sum and difference identities</li> <li>identify contexts suitable for modelling by trigonometric functions and use them to solve practical problems</li> </ul>
Week 11 (4 hours)	Topic 1.3: Counting and probability	Combinations $(1.3.1 - 1.3.5)$ • understand the notion of a combination as a set of $r$ objects taken from a set of $n$ distinct objects • use the notation $\binom{n}{r}$ and the formula $\binom{n}{r} = \frac{n!}{r!(n-r)!}$ for the number of combinations of $r$ objects taken from a set of $n$ distinct objects • expand $(x+y)^n$ for small positive integers $n$ • recognise the numbers $\binom{n}{r}$ as binomial coefficients (as coefficients in the expansion of $(x+y)^n$ ) • use Pascal's triangle and its properties

Time placement (and allocation)	Topic/s	Key teaching points – Syllabus reference/s
		Semester 1 (Unit 1)
Week 12 (4 hours)	Topic 1.3: Counting and probability	<ul> <li>Language of events and sets (1.3.6 - 1.3.8)</li> <li>review the concepts and language of outcomes, sample spaces, and events, as sets of outcomes</li> <li>use set language and notation for events, including: <ul> <li>a. A (or A') for the complement of an event A</li> <li>b. A ∩ B and A ∪ B for the intersection and union of events A and B respectively</li> <li>c. A ∩ B ∩ C and A ∪ B ∪ C for the intersection and union of the three events A, B and C respectively</li> <li>d. recognise mutually exclusive events</li> </ul> </li> <li>use everyday occurrences to illustrate set descriptions and representations of events and set operations</li> </ul>
Week 13 (4 hours)	Topic 1.3: Counting and probability	<ul> <li>Review of the fundamentals of probability (1.3.9 - 1.3.12)</li> <li>review probability as a measure of 'the likelihood of occurrence' of an event</li> <li>review the probability scale: 0 ≤ P(A) ≤ 1 for each event, A with P(A) = 0 if A is an impossibility and P(A) = 1 if A is a certainty</li> <li>review the rules: P(A) = 1 - P(A) and P(A ∪ B) = P(A) + P(B) - P(A ∩ B)</li> <li>use relative frequencies from data as estimates of probabilities</li> </ul>
Weeks 14 (4 hours)	Topic 1.3: Counting and probability	<ul> <li>Conditional probability and independence (1.3.13 – 1.3.17)</li> <li>understand the notion of a conditional probability and recognise and use language that indicates conditionality</li> <li>use the notation P(A B) and the formula P(A ∩ B) = P(A B)P(B)</li> <li>understand the notion of independence of an event A from an event B, as defined by P(A B) = P(A)</li> <li>establish and use the formula P(A ∩ B) = P(A)P(B) for independent events A and B, and recognise the symmetry of independence</li> <li>use relative frequencies obtained from data as estimates of conditional probabilities and as indications of possible independence of events</li> </ul>
Week 15		Revision and end of Unit 1 assessment

# Sample course outline

# Mathematics Methods – ATAR Year 11

## Unit 2

In Unit 2 students will be provided with opportunities to:

- understand the concepts and techniques used in algebra, sequences and series, functions, graphs, and calculus
- solve problems in algebra, sequences and series, functions, graphs, and calculus
- apply reasoning skills in algebra, sequences and series, functions, graphs, and calculus
- interpret and evaluate mathematical and statistical information and ascertain the reasonableness of solutions to problems
- communicate arguments and strategies when solving problems.

This course outline assumes an allocation of 4 hours contact time per week for the course.

Time placement	Topic/s	Key teaching points – Syllabus reference/s
(and allocation)		
		Semester 2 (Unit 2)
Weeks 16–18 (10 hours)	Topic 2.1: Exponential functions	<ul> <li>review indices (including fractional and negative indices) and the index laws</li> <li>use radicals and convert to and from fractional indices</li> <li>understand and use scientific notation and significant figures</li> <li>Exponential functions (2.1.4 - 2.1.7)</li> </ul>
		<ul> <li>establish and use the algebraic properties of exponential functions</li> <li>recognise the qualitative features of the graph of y = a<sup>x</sup> (a &gt; 0), including asymptotes, and of its translations (y = a<sup>x</sup> + b and y = a<sup>x-c</sup>)</li> <li>identify contexts suitable for modelling by exponential functions and use them to solve practical problems</li> <li>solve equations involving exponential functions using technology, and algebraically in simple cases</li> </ul>
Weeks 18–19 (6 hours)	Topic 2.2: Arithmetic and geometric sequences and series	<ul> <li>Arithmetic sequences (2.2.1 - 2.2.4)</li> <li>recognise and use the recursive definition of an arithmetic sequence t<sub>n+1</sub> = t<sub>n</sub> + d</li> <li>develop and use the formula t<sub>n</sub> = t<sub>1</sub> + (n - 1)d for the general term of an arithmetic sequence and recognise its linear nature</li> <li>use arithmetic sequences in contexts involving discrete linear growth or decay, such as simple interest</li> <li>establish and use the formula for the sum of the first n terms of an arithmetic sequence</li> </ul>

Time placement (and allocation)	Topic/s	Key teaching points – Syllabus reference/s
(		Semester 2 (Unit 2)
Weeks 20–22 (9 hours)	Topic 2.2: Arithmetic and geometric sequences and series	<ul> <li>Geometric sequences (2.2.5 - 2.2.9)</li> <li>recognise and use the recursive definition of a geometric sequence t<sub>n+1</sub> = t<sub>n</sub>r</li> <li>develop and use the formula t<sub>n</sub> = t<sub>1</sub>r<sup>n-1</sup> for the general term of a geometric sequence and recognise its exponential nature</li> <li>understand the limiting behaviour as n → ∞ of the terms t<sub>n</sub> in a geometric sequence and its dependence on the value of the common ratio r</li> <li>establish and use the formula S<sub>n</sub> = t<sub>1</sub> r<sup>n-1</sup>/r-1 for the sum of the first n terms of a geometric sequence</li> <li>use geometric sequences in contexts involving geometric growth or decay, such as compound interest</li> </ul>
Weeks 22–24 (9 hours)	Topic 2.3: Introduction to differential calculus	<ul> <li>Rates of change and the concept of the derivative (2.3.1 - 2.3.9)</li> <li>interpret the difference quotient  <sup>f(x+h)-f(x)</sup>/<sub>h</sub> as the average rate of change of a function f</li> <li>use the Leibniz notation δx and δy for changes or increments in the variables x and y</li> <li>use the notation <sup>δy</sup>/<sub>δx</sub> for the difference quotient <sup>f(x+h)-f(x)</sup>/<sub>h</sub> where y = f(x)</li> <li>interpret the ratios <sup>f(x+h)-f(x)</sup>/<sub>h</sub> and <sup>δy</sup>/<sub>δx</sub> as the slope or gradient of a chord or secant of the graph of y = f(x)</li> <li>examine the behaviour of the difference quotient <sup>f(x+h)-f(x)</sup>/<sub>h</sub> as h → 0 as an informal introduction to the concept of a limit</li> <li>define the derivative f'(x) as lim <sup>f(x+h)-f(x)</sup>/<sub>h</sub></li> <li>use the Leibniz notation for the derivative: <sup>dy</sup>/<sub>dx</sub> = lim <sup>δy</sup>/<sub>δx</sub> and the correspondence <sup>dy</sup>/<sub>dx</sub> = f'(x) where y = f(x)</li> <li>interpret the derivative as the instantaneous rate of change</li> <li>interpret the derivative as the slope or gradient of a tangent line of the graph of y = f(x)</li> </ul>
Weeks 24–26 (9 hours)	Topic 2.3: Introduction to differential calculus	<ul> <li>Computation and properties of derivatives (2.3.10 - 2.3.15)</li> <li>estimate numerically the value of a derivative for simple power functions</li> <li>examine examples of variable rates of change of non-linear functions</li> <li>establish the formula d/dx (x<sup>n</sup>) = nx<sup>n-1</sup> for non-negative integers n expanding (x + h)<sup>n</sup> or by factorising (x + h)<sup>n</sup> - x<sup>n</sup></li> <li>understand the concept of the derivative as a function</li> <li>identify and use linearity properties of the derivative</li> <li>calculate derivatives of polynomials</li> </ul>

Time placement	Topic/s	Key teaching points – Syllabus reference/s
(and allocation)		
Semester 2 (Unit 2)		
Weeks 26–29 (12 hours)	Topic 2.3: Introduction to differential calculus	<ul> <li>Applications of derivatives and anti-derivatives (2.3.16 - 2.3.22)</li> <li>determine instantaneous rates of change</li> <li>determine the slope of a tangent and the equation of the tangent</li> <li>construct and interpret position-time graphs with velocity as the slope of the tangent</li> <li>recognise velocity as the first derivative of displacement with respect to time</li> <li>sketch curves associated with simple polynomials, determine stationary points, and local and global maxima and minima, and examine behaviour as x → ∞ and x → -∞</li> <li>solve optimisation problems arising in a variety of contexts involving polynomials on finite interval domains</li> <li>calculate anti-derivatives of polynomial functions</li> </ul>
Week 29–30		Revision and end of course assessment